

Reg No.: \_\_\_\_\_

Name: \_\_\_\_\_

**APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY**  
**FOURTH SEMESTER B.TECH DEGREE EXAMINATION(R&S), MAY 2019**

**Course Code: CE208**

**Course Name: GEOTECHNICAL ENGINEERING I (CE)**

Max. Marks: 100

Duration: 3 Hours

**(Graph sheets - ordinary as well as semi-log - may be supplied on request)**

**PART A**

*Answer any two full questions, each carries 15 marks*

Marks

- |   |  |   |
|---|--|---|
| 1 | a) Void ratio of a soil decreases from 1.15 to 0.85 upon densification. What is the corresponding percentage decrease in volume?   | 6 |
|   | b) A soil sample is compacted to a bulk unit weight of $18\text{kN/m}^3$ at 10% water content. Find the void ratio and degree of saturation of the soil. Also find the weight of water to be added to $100\text{ m}^3$ of this soil for complete saturation. Assume $G=2.75$ | 9 |
| 2 | a) A clay has a liquid limit of 52% and shrinkage limit of 17%. If a specimen of this soil shrinks from a volume of $10000\text{mm}^3$ at liquid limit to $6010\text{ mm}^3$ at shrinkage limit determine the specific gravity of soil grains.                               | 6 |
|   | b) Draw I.S. Plasticity chart and mark the details. What is its practical application?   | 9 |
| 3 | a) Starting from the fundamentals, derive an expression for bulk unit weight in terms of air content, water content and percentage air voids.  | 8 |
|   | b) Why is a deflocculating agent correction needed for observed hydrometer reading? What is the nature of correction [positive or negative]? Mention a commonly used deflocculating agent.   | 7 |

**PART B**

*Answer any two full questions, each carries 15 marks*

- |   |   |    |
|---|---|----|
| 4 | a) Differentiate between critical hydraulic gradient and exit gradient.   | 6  |
|   | b) A sand deposit has: void ratio=0.85; $G=2.7$ . WT is at 1.5m depth below GS and the soil above WT is also fully saturated due to capillarity. Determine the total, neutral and effective stress at 1.2m and 4.2m beneath the GS.   | 9  |
| 5 | a) Minor and major principal stresses at failure for a sample of soil subjected to triaxial test are 150kPa and 536.6kPa respectively. Determine the angle of internal friction of this soil, if its cohesion is 25kPa. Also determine (i) the angle made by the failure plane with the horizontal; and (ii) direction of maximum | 15 |

shear stress.

- 6 a) State any 4 merits of triaxial test over direct shear test. 6
- b) A permeameter of 80mm diameter contains a 2-layered soil sample of length 9  
300mm (200mm thick soil having  $k=4 \times 10^{-6}$  mm/sec. underlain by 100mm thick  
soil with  $k=4 \times 10^{-7}$  mm/sec.) If a falling head permeability test is conducted on  
this soil with a standpipe of diameter 15mm., what would be the time taken the  
time taken for the head to fall from 500mm to 100mm?

### PART C

*Answer any two full questions, each carries 20 marks*

- 7 a) The following observations were recorded in a consolidation test on a fully 20  
saturated sample. Initial height of sample= 20mm; diameter of sample=60mm;

Applied pressure (kPa)	0	25	50	100	200	400	800
Height of soil sample (mm)	20	17.5	17.1	16.5	15	13.5	12.0

Dry weight of soil sample=76.34gms.;  $G=2.7$ ; Draw e-log p graph and estimate  
compression index.

- 8 a) An embankment is constructed at dry density-OMC condition ( $20\text{kN/m}^3$  and 9%). 14  
Borrow area soil has:  $G=2.5$ . Determine degree of saturation and percentage air  
voids of the compacted soil. Also determine the theoretical maximum dry density  
to which the sample can be compacted. Assume density of water =  $10\text{kN/m}^3$ .
- b) What is meant by factor of safety with respect to cohesion. When does it become 6  
equal to factor of safety with respect to shear strength?
- 9 a) How can the pre-consolidation pressure on clay be estimated? 10
- b) What are the forces considered in friction circle method of slope analysis? 10  
Suggest any 4 methods for improving the stability of a slope.

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